Issued September 12, 1908.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF CHEMISTRY—BULLETIN No. 117.

H. W. WILEY, Chief of Bureau.

COMMERCIAL SICILIAN SUMAC.

By

F. P. VEITCH,

CHIEF OF THE LEATHER AND PAPER LABORATORY.

INCLUDING NOTES ON THE MICROSCOPICAL EXAMINATION OF SICILIAN SUMAC AND ITS ADULTERANTS,

By

B. J. HOWARD,

CHIEF OF THE MICROCHEMICAL LABORATORY.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1908.

Issued September 12, 1908.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF CHEMISTRY—BULLETIN No. 117.

H. W. WILEY, Chief of Bureau.

COMMERCIAL SICILIAN SUMAC.

By

F. P. VEITCH,

CHIEF OF THE LEATHER AND PAPER LABORATORY.

INCLUDING NOTES ON THE MICROSCOPICAL EXAMINATION OF SICILIAN SUMAC AND ITS ADULTERANTS,

By

B. J. HOWARD,

CHIEF OF THE MICROCHEMICAL LABORATORY.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1908.

LETTER OF TRANSMITTAL.

United States Department of Agriculture,
Bureau of Chemistry,
Washington, D. C., June 3, 1908.

Sir: I have the honor to submit for your approval a report of two investigations, conducted in 1905 and 1907, concerning the quality of Sicilian sumac imported into this country, chemical and microscopical examination of a large number of samples having been made. This study was made in the Leather and Paper Laboratory of the Bureau of Chemistry because of its direct bearing on the leather trade interests of the country, as well as because of its relation to the increased production of sumac in the United States. Material assistance in the performance of the laboratory work involved in this investigation was rendered by H. H. Hurt and C. C. Smoot, of the Leather and Paper Laboratory. I recommend the publication of this report as Bulletin 117 of the Bureau of Chemistry

Respectfully,

H. W. Wiley,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

ILLUSTRATIONS.

COMMERCIAL SICILIAN SUMAC.

QUANTITY AND VALUE OF IMPORTED SUMAC.

Sicilian sumac is the best vegetable tanning material known for pale colors and soft tannage, and is consequently extensively used for moroccos, roans, skivers, etc., and for brightening the color of leather tanned with dark materials. An extended investigation[a] by a committee of the Society of Arts has shown conclusively that sumac-tanned leathers are less likely to be attacked by light and gas fumes, and hence better suited for use in bookbinding than any other known vegetable tannage.

As good "masculino," or Sicilian mountain sumac, contains from 25 to 35 per cent of tannin which is absorbed by hides, it is a very high grade and desirable tanning material, commanding a high price. Consequently it is adulterated to a considerable extent, and much complaint has arisen during the past three or four years both from importers and tanners about the mixing of sumac leaves with stems or other lower-grade and darker-colored substances, an adulteration which not only affects the material itself, but also darkens greatly the leather tanned. In view of these facts it has been deemed advisable to make a careful examination of imported Sicilian sumac.

Although mineral tanning has largely replaced vegetable tanning in the production of morocco, the importations of foreign sumac have remained about the same for a number of years, as shown by Table I, prepared from statistics issued by the Department of Commerce and Labor.

TABLE I.—*Quantity and value of sumac imported into the United States from 1870 to 1907.*

Year.	Quantity.	Value.
	Pounds.	*Dollars.*
1870	9,634,367	418,919
1875	16,718,678	511,941
1890	16,397,213	.....
1895	12,179,203	235,157
1900	10,335,980	.....
1905	15,583,334	225,036
1906	14,886,482	235,403
1907	12,244,907	259,974

[a] Journal of the Society of Arts, London, 1901, p. 14.

CULTURE AND PREPARATION FOR MARKET.

Sicilian sumac (*Rhus coriaria*) is a shrubby bush which grows chiefly in Sicily and Tuscany, and succeeds on any well-drained soil, though the best development is secured in calcareous soils. That grown in the mountainous districts around Palermo is known as "masculino" and contains the highest percentage of tannin—from 25 to 35 per cent—while that grown on the plains is called "feminella" and usually contains less than 25 per cent. Andraesch[a] states that "feminella" is a variety distinct from "masculino," stronger, having larger leaves, and containing a darker tannin but less of it than the "masculino." Examinations of both kinds of leaf have failed to show any differences, and communication with importers brings out the fact that no distinction is made except on a basis of the tannin content.

While in this country no attention is devoted to the cultivation of the native sumac, in Sicily it is commonly cultivated, as the yield and value of the leaf are both much greater than from the wild plant. Sumac may be grown on poor, stony, volcanic, or calcareous soils, not too far from the sea, and on mountain sides well exposed to the sun. Sudden changes of temperature or frequent rains, especially when the material is about ready to harvest, greatly injure its quality and strength.

The plant may be propagated from the young shoots which form each year about the mature plant, from cuttings of the well-ripened stem, or from the seed. The first method is the one generally followed. The shoots should be at least a foot high, be well supplied with buds, come from young, healthy plants, and have short chain roots well supplied with rootlets. When cuttings from the wood are made, they must be first rooted in a propagation frame at a temperature of about 70° F. The young plants are set in well-cultivated land in rows 2 feet apart, and are given three or four cultivations during the growing season to keep the land free from weeds and grass.

The first crop is harvested the year after planting, either by pruning or by picking the leaves. Harvesting begins about the middle of July, the time being governed by the development of the leaf, the object being to harvest when the leaf has acquired the deepest green color and reached its maximum weight. If the leaves are gathered by hand, harvesting begins when the first and lowest leaves have reached maturity, usually in May, and two subsequent gatherings are made as the younger leaves become fully developed, once late in July or early in August, and again in September, when the extremities of the branches are gathered. After being picked, the shoots and leaves

[a] Abs., J. Soc. Chem. Ind., 1898, **17**: 774.

are allowed to lie in the field in order that they may become partially cured, or they are immediately taken to the barn for curing. It is important that the material be not exposed to rains or to intense sunshine during curing, as the quality of the product is greatly injured thereby. As a rule, therefore, the best product may be obtained by drying under cover, being careful to turn the leaves frequently to prevent molding. After drying, the leaves and stems are roughly ground, baled, and sold as "leaf sumac," or they are reground in edge runner mills, sifted to remove the stems, ventilated, bagged, and sold as "ground sumac."

It can readily be seen that the dryness of the product and the proportion of stems that remains with the leaf of the baled and ground sumac will vary considerably according to the care with which it is handled. As these stems not only contain less tannin, but also have a deeper color than the leaf, the value of the product may be materially influenced simply by the method of preparation for market.

NATURE OF ADULTERATION.

In addition to the incorporation of large quantities of the stem with the leaf, a practice which must be regarded as an adulteration, a number of other materials less valuable for tanning than sumac are mixed with the leaf. By far the most common adulterant, indeed the one almost exclusively used in the sumacs imported into this country, is the leaf of *Pistacia lentiscus* commonly called lentiscus or lentisco. This leaf contains from 12 to 20 per cent of a catechol tannin, and leather tanned with sumac adulterated with this leaf darkens and reddens on exposure to air, for which reason its use is decidedly objectionable in the manufacture of certain grades of leather. The lentiscus is mixed with ground sumac at the rate of from 20 to 50 per cent, and with the sumac leaves at the rate of 20 to 30 per cent. Other leaves much less generally used in adulterating sumac are those of *Coriaria myrtifolia* ("stinco"), *Tamarix africana* ("brusca"), *Ailanthus gladulosa*, *Vitis vinifera* (grape vine), and some species of the Rhus family other than *coriaria*, as well as foreign material. Sumac from which tannin has been extracted or which has been injured by exposure is also mixed with the normal product. None of these adulterants can be detected by a casual examination of the sumac, but special methods, which will be described later, have been devised for this purpose.

The Italian laws require that all adulterated sumac offered for export shall be distinctly labeled with the kind and quantity of the adulterant, but it is claimed that this law is frequently evaded, and the trade journals state that a very large percentage of adulterated sumac has been shipped to this country. Some have tried to justify

this by asserting that the market here demands sumac at such a price that the genuine "masculino" sumac can not be sold. However this may be, it appears important that the actual conditions as to purity of imported sumac should be brought fully to the attention of the American importers and buyers, that they may take such steps as appear advisable for their protection.

INVESTIGATION OF 1905.

SECURING SAMPLES FOR ANALYSIS.

Through the cooperation of the customs division of the Treasury Department, the samples for examination were secured at the chief ports of entry in accordance with the instructions in the following letter:

JANUARY 17, 1905.

The SECRETARY OF THE TREASURY.

SIR: In connection with the work of the Bureau of Chemistry of this Department it is desired to obtain samples of sumac leaves and ground sumac entering the ports of New York, Boston, and Baltimore. If in harmony with the regulations of your office, I should be glad if you would issue such instructions to the collectors of the ports named as will enable us to secure the material mentioned.

In taking the samples, the names and addresses of the consignor and of the consignee, together with a copy of all the marks on the bags, should be secured and these data forwarded with the proper samples.

Samples should be drawn from about 5 per cent of each invoice by passing a slotted sampling tube from top to bottom of the bags, thoroughly mixing the subsamples of each invoice thus obtained and taking from 1 to 2 pounds of this to be forwarded to this Department with the data above mentioned. * * *

In compliance with this request samples of leaf and ground sumac were taken by the Treasury Department, chiefly through the ports of New York and Boston, and delivered to the Bureau of Chemistry.

METHODS OF EXAMINATION.

The samples were submitted to both chemical and microscopic analysis in order to determine their composition and distinguish the adulterants if such were present. An extractor especially adapted to this purpose was used, numerous experiments[a] having shown that with this apparatus the extraction of sumac is more complete and the operation is more easily conducted than with other extractors. Furthermore, the color of the resulting extract is less affected than when the ordinary copper Soxhlet, such as is quite commonly employed in tannery work, is used.

Inasmuch as the extraction is more complete with this form of extractor than with those formerly used, the results on tannin are,

[a] J. Amer. Chem. Soc., 1905, **27**; 724; 1906, **28**; 505.

as a rule, higher than those obtained and published a few years ago, when rarely more than 25 per cent of tannin was determined in even the best Sicilian sumac. The high results here reported, which are now obtained quite generally by others, are probably due, therefore, to more complete extraction and improved methods of analysis rather than to improvement in the quality of sumac. It has been the opinion among tannery chemists, based on the work of Semour-Jones, Palmer, Parker, and Proctor, of England, that most tanning materials are best extracted at temperatures below boiling; thus sumac is supposed to yield the highest results by extracting below 60° C. The work done in the Bureau of Chemistry makes this opinion no longer tenable, as the highest results have been obtained at from 60° to 90° C. according to the following method, which is now used in this laboratory in extracting all kinds of tannery materials.

Place in the extractor, preparatory to receiving the sample, a perforated porcelain disk and cover with a mat of asbestos or of purified cotton. Place the weighed sample of tanning material in a beaker and moisten with hot water at from 60° to 90° C. until it has the consistency of a thin paste; then transfer it to the extractor, removing all the material from the beaker with a jet of hot water. Let the water percolate through the extractor into a Jena boiling flask, press the material down well, cover with a perforated porcelain plate, and return the percolate to the extractor until it runs clear. Allow a total volume of from 300 to 400 cc to percolate at a temperature of from 60° to 90° C. Place about 250 cc of fresh water in a clean receiving flask and connect it with the extractor by means of a block-tin condenser, heat to boiling, and finish the extraction at steam heat, replacing the extract with fresh portions of water two or three times and being careful to keep the total volume of extract within a liter. When the extraction is completed, usually in from twenty to twenty-five hours, combine the hot extracts in a liter flask and make up to volume when cold. Only the best nonsoluble glass and block tin must be used in the extraction apparatus, as the alkali dissolved from ordinary glass materially dissolves "reds" insoluble in cold water. Make the determination of tannin and other constituents of the extracts according to the official methods of the Association of Official Agricultural Chemists.[a]

Determine the moisture by drying 5 grams of substance in a flat-bottomed dish for five hours and check the weight again after drying for three hours.

Determine the crude ash in the residue from the moisture by incineration at a low red heat until all carbon is burned away, then cool and weigh the residue.

[a] U. S. Dept. Agr., Bureau of Chemistry, Bul. 107, p. 35.

To determine the sand, treat the ash with about 10 per cent hydrochloric acid and warm gently for several hours, filter, wash thoroughly, ignite, and weigh. The weight so obtained is considered as sand.

Make the color determination of the extract with the Lovibond tintometer, the readings being made in the 1-inch cell on the soluble solids filtrate, and calculate the results to a basis of 0.5 per cent of tannin in the solution. Give the results in terms of red and yellow, the black being subtracted for the red and yellow readings.

It should be borne in mind that the color determination so obtained does not necessarily represent the color of the extract obtained in tannery practice. Indeed, it is almost certain that the color of the extracts as thus prepared for analysis is considerably deeper than that of the extract obtained from the same materials by ordinary tannery methods. These results, then, only show the relative colors produced by different samples under like conditions of extraction and should be compared only among themselves.

DISCUSSION OF RESULTS OF ANALYSIS.

In tabulating the data on these samples, the name and address of the consignor, when these appeared on the containers, the name and address of the consignee, the approximate date of entry, and the place of sampling are given in connection with the chemical analysis and the microscopic examination. Care was taken to secure samples only from invoices imported in good condition.

As is shown in Table II (p. 12), the average percentage of tannin in all the samples of sumac is 28.8 per cent, which is higher than the results generally given in the literature for Sicilian sumac. As has been said, it is not believed that this is due to any improvement in the character of the leaf now grown, but rather to improved methods of extraction and also to changes in methods of analysis.

Approximately 41 per cent of the invoices from which samples were taken were mixed with lentiscus, this being practically the only adulterant employed, except sumac stems, which were present in excessive quantities in a number of samples. The adulterated samples contained from 19.6 per cent to 33.3 per cent and averaged 26.6 per cent of tannin, or 2.2 per cent less than the average of all the sumac samples. A number of the samples contained an excess of sumac stems, and the average tannin content of these was 29.9 per cent, which indicates that the stems are not added in such large quantities as is the lentiscus. The samples of pure sumac contained from 27.4 to 35.1 per cent and averaged 31.9 per cent of tannin.

Adulteration of the average pure sumac with 30 per cent of the average lentiscus would yield an article having the same percentage

of tannin as the average adulterated samples—that is, approximately 27 per cent. The figures, therefore, indicate an average adulteration of 30 per cent of lentiscus, which is possibly below the actual practice, as high-grade sumacs are more likely to be adulterated than the lower grades. Several of the samples, however, contain so little tannin that it is evident that either an exceptionally low grade of sumac was used or that lentiscus was almost entirely substituted.

Ten samples were marked as containing lentiscus. In two cases the examination proved the sample to be pure sumac. In no case was more than a 25 per cent adulteration admitted. The average tannin content of the six admittedly adulterated samples is 27.5 per cent, practically identical with the average of all the adulterated samples.

If the general statement that the "feminella" sumac contains less than 25 per cent of tannin is accepted, it would appear that none of the adulterated samples was plain-grown sumac. As this classification seems to be based solely on the tannin content, it may be ignored except in so far as it is an expression of the agricultural fact that sumac grown on the high ground contains more tannin than that grown in the valleys.

Leather tanned with sumacs adulterated with lentiscus is darker than that tanned with pure Sicilian sumac, and the determination of the color of the extracts from these samples is in harmony with this fact. The darkest extract from a pure sumac contains less red coloring matter than the lightest-colored extract from an adulterated sample, while the extracts from the samples of lentiscus contained several times as much coloring matter as the darkest pure sumac extract.

TABLE II.—*Chemical and microscopical examination of Sicilian sumac sampled in 1905.*

Laboratory No.	Consignor.	Consignee.	Collection of samples.		Statement on bags as to purity.	Chemical examination (per cent).										Microscopical examination.	Presence of lentiscus as indicated by color after drying.
			Place.	Date.		Moisture.	Ash.	Sand.	Total extract.	Soluble extract.	Insoluble extract.	Non-tannins.	Available tannins.	Color in one-half per cent solution.			
														Red.	Yellow.		
74	G. S. Benanti, Palermo.	H. M. Rau, New York.	Boston		Ground sumac	8.08	7.57	1.62	50.0	44.6	5.4	18.6	26.0	3.8	6.7	Lentiscus abundant.	Lentiscus.
75	Giovanni Riso, Palermo.	O. S. Janney & Co., Boston.	do		do	8.05	7.65	1.44	49.6	45.5	4.1	20.1	25.4	4.6	10.7	do	Do.
76	P. Savona & Co., Palermo.	A. Klipstein, Boston.	do		do	8.68	7.50	1.46	49.9	47.0	2.9	19.8	27.2	3.8	9.4	do	Do.
77	do	do	do		do	8.54	6.99	1.33	51.0	48.3	2.7	19.4	28.9	3.5	8.7	do	Sumac.
78	G. Terrasi, Palermo.	Winslow Bros. & Smith, Boston.	do	Jan. 31, 1905	do	9.00	8.40	1.65	55.2	51.8	3.4	21.0	30.8	3.2	12.8	Pure sumac	Do.
79	Unknown	John Harper & Co., Philadelphia.	Philadelphia		Pure leaf sumac	7.42	6.17	.38	58.7	55.4	3.3	20.3	35.1	1.3	3.8	do	Do.
80	do	do	do		15 per cent lentiscus leaf.	7.88	6.29	.48	56.0	53.2	2.8	19.9	33.3	1.9	5.6	Some lentiscus	Do.
81	do	do	do		25 per cent lentiscus leaf.	7.73	6.12	.91	53.8	51.8	2.0	20.9	30.9	2.9	6.4	do	Do.
82	G. B. Casiglia & Figlio, Palermo.	J. S. Bent, Boston.	Boston		Ground sumac	8.61	9.19	16.3	51.3	47.1	4.2	18.7	28.4	3.6	10.5	do	Do.
83	M. Pojero & Co., Palermo.	W. L. Montgomery & Co., Boston.	do		Pure Sicily sumac leaf.	6.93	7.60	.96	55.3	51.5	3.8	19.3	32.2	1.7	6.5	Stems rather abundant.	Do.
85	G. Dalia & Fi., Palermo.	W. D. Byron & Sons, Williamsport, Md.	Williamsport, Md.		Superior quality, warranted pure.	8.56	8.36	.98	55.5	51.3	4.2	18.7	32.6	2.1	7.2	Pure sumac.	Do.
86	P. Savona & Co., Palermo.	do	do		Guaranteed pure, extra ventilated.	8.29	7.45	1.18	52.2	47.5	4.7	19.4	28.1	4.9	8.9	Lentiscus abundant.	Lentiscus.
87	M. Pojero & Co., Palermo.	do	do		Warranted genuine prime quality.	8.21	8.09	1.11	55.9	51.6	4.3	19.8	31.8	2.3	6.3	Some stems	Sumac.
88	G. Dalia & Fi., Palermo.	W. L. Montgomery & Co., Boston.	Boston		Pure ground sumac.	7.15	8.45	1.39	56.5	52.1	4.4	19.5	32.6	2.5	6.7	Pure sumac	Do.
89	Unknown	J. M. Harper & Co., Philadelphia.	Philadelphia		Powdered lentiscus.	6.70	6.74	1.45	45.0	39.4	5.6	22.2	17.2	10.1	41.1	Lentiscus only	
90	Giovanni Terrassi, Palermo.	do	do		Pure ground sumac.	6.81	9.21	1.68	56.6	52.5	4.1	19.6	32.9	1.7	6.0	Sumac only	Sumac.

124	Francisco Basso & Co., Palermo.	J. S. Young & Co., Baltimore.	Baltimore		Guaranteed pure leaf, extra ventilated.	7.61	6.91	.72	52.4	49.1	3.3	20.3	28.8	2.9	7.9	Lentiscus abundant, some stems.	Do.
125	G. S. Benanti, Palermo.	do	do		Warranted pure leaf, extra ventilated.	8.13	7.50	.94	50.1	46.9	3.2	18.7	28.2	2.2	6.7	Some sumac stems	Do.
126	Francisco Basso & Co., Palermo.	do	do		Guaranteed pure leaf.	6.89	6.11	.52	57.3	54.8	2.5	21.5	33.3	2.3	6.0	Pure sumac	Do.
127	G. S. Benanti, Palermo.	do	do		Warranted pure leaf, extra ventilated.	7.09	6.36	.44	52.5	49.7	2.8	20.6	29.1	2.3	7.3	Some stems	Do.
128	Francisco Basso & Co., Palermo.	do	do		do	7.46			52.7	49.6	3.1	20.0	29.6	2.1	7.7	Lentiscus abundant.	
129	P. Savona & Co., Palermo.	Pfister & Vogel, Milwaukee.	Milwaukee		do	6.67	8.54	1.63	54.0	48.1	5.9	20.1	28.0	9.3	27.8	Lentiscus very abundant.	Lentiscus.
132	Unknown	Stamford Mfg. Co., Stamford, Conn.	Stamford		Powdered lentiscus.	8.07	6.84	1.45	45.0	39.1	5.9	22.7	16.4	7.8	37.4	Lentiscus only	Do.
133	do	do	do		Ground lentiscus.	8.17	6.24	.78	42.2	37.8	4.4	20.6	17.2	9.7	21.9	Lentiscus and some stems.	Do.
135	Giovanni Riso, Palermo.	O. S. Janney & Co., New York.	New York	Mar. 6, 1905	Ground sumac	6.93	8.02	1.36	50.1	44.6	5.5	19.1	25.5	5.0	15.4	Lentiscus abundant, trace of tamarix.	Do.
136	Pro forma entry	F. R. Leonori & Co., New York.	do	Mar. 28, 1905	100 per cent warranted pure, extra ventilated.	7.59	9 20	1.59	57.0	51.1	5.9	19.0	32.1	2.3	9.4	Pure sumac	Sumac.
137	Giovanni Riso, Palermo.	Brown Bros. & Co., New York.	do		Guaranteed pure	7.11	7.78	1.28	48.8	44.4	4.4	18.6	25.8	4.5	16.5	Lentiscus abundant.	Lentiscus.
138	Giovanni Terrasi, Palermo.	Harbler & Co., New York.	do		100 per cent warranted pure, extra ventilated.	7.44	8.46	1.51	56.1	51.1	5.0	18.6	32.5	1.9	9.0	Lentiscus, trace	Sumac.
139	Paolo Graziano. Palermo.	D. A. Shaw & Co., New York.	do	Mar. 23, 1905	Superior quality, warranted pure.	7.01	8.37	1.84	50.0	46.2	3.8	20.8	25.4	4.0	15.5	Lentiscus abundant.	Lentiscus.
140	P. Mormino, Termini	B. Voigt, New York	do	do		6.98	8.51	1.63	50.2	46.0	4.2	18.6	27.4	3.6	11.8	do	Do.
141	Giovanni Riso, Palermo.	Core & Herbert, New York.	do	Mar. 22, 1905	Superior quality, warranted pure.	7.32	7.32	1.14	48.9	44.2	4.7	18.6	25.3	4.6	14.8	do	Do.
143	Paolo Graziano, Palermo.	Winter & Smillie, c/o R. Leonori & Co., New York.	do	Mar. 31, 1905	Guaranteed pure, extra ventilated leaf.	7.22	6.53	1.29	45.5	42.4	3.1	22.8	19.6	11.2	23.4	do	Do.
144	P. Savona & Co., Palermo.	A. Klipstein, New York.	do	Mar. 23, 1905	Superior quality, warranted pure.	6.34	8.00	.79	51.6	46.8	4.8	21.1	25.7	2.3	7.5	Some stems	Sumac.
147	G. Dalia & Fi., Palermo.	W. L. Montgomery & Co., New York.	do	do	Ground sumac, guaranteed pure, prime quality.	7.36	8.70	1.65	54.7	51.2	3.5	20.1	31.1	2.3	8.5	Pure sumac	Do.
148	M. Pojero, Palermo.	W. L. Montgomery & Co., Boston.	Boston	Mar. 20, 1905	Extra ventilated, warranted 100 per cent pure.	7.24	8.78	1.62	55.1	51.4	3.7	18.6	32.8	1.4	5.1	do	Do.
149	E. Bertini, Palermo.	Winslow Bros. & Smith Co., Boston	do	Mar. 18, 1905		7.02	8.81	1.73	56.6	52.6	4.0	17.7	34.9	1.6	5.9	do	Do.

TABLE II.—*Chemical and microscopical examination of Sicilian sumac sampled in 1905*—Continued.

Laboratory No.	Consignor.	Consignee.	Collection of samples.		Statement on bags as to purity.	Chemical examination (per cent).										Microscopical examination.	Presence of lentiscus as indicated by color after drying.
			Place.	Date.		Moisture.	Ash.	Sand.	Total extract.	Soluble extract.	Insoluble extract.	Non-tannins.	Available tannins.	Color in one-half per cent solution. Red.	Color in one-half per cent solution. Yellow.		
150	P. Savona & Co., Palermo.	A. Klipstein & Co., Boston.	Boston	Mar. 17, 1905	Guaranteed pure, extra ventilated.	6.90	9.12	1.90	48.5	45.4	3.1	18.6	24.8	4.0	11.7	Some lentiscus	Lentiscus.
151	do	do	do	do	do	7.15	8.59	1.78	49.2	46.3	2.9	18.5	27.8	4.1	9.8	do	Do.
152	Fratelli Savona, Palermo.	W. L. Montgomery & Co., Boston.	do	Mar. 20, 1905	Extra ventilated, warranted pure.	7.15	9.66	2.49	53.9	47.6	6.3	20.5	27.1	3.6	17.9	do	Do.
153	V. Vitrano, Palermo.	Hertzel, Feltmann & Co., New York.	do	do	Pure sumac	7.61	8.95	1.58	57.2	50.5	6.7	20.2	30.3	2.3	10.4	Pure sumac	Sumac.
154	E. Bertini, Palermo.	A. C. Lawrence Leather Co., Boston.	do	Mar. 18, 1905	Extra ventilated, guaranteed pure.	7.54	7.88	1.55	57.5	53.0	4.5	19.0	34.0	.8	4.7	do	Do.
155	Giovanni Riso, Palermo.	O. S. Janney & Co., Boston.	do	do	Ventilated, warranted pure.	7.78	8.07	1.34	52.5	48.7	3.8	19.1	29.6	2.2	10.9	Some lentiscus	Do.
156	C. Wederkind Co	Leber & Meyer, New York.	do	Mar. 20, 1905	Extra ventilated	7.33	7.42	1.24	50.0	46.7	3.3	19.8	26.9	4.0	12.4	Lentiscus abundant.	Lentiscus.
157	V. Vitrano di Gpe., Palermo.	Hertzel, Feltmann & Co., New York.	do	do	Pure, ventilated	7.52	9.56	1.99	54.5	49.4	5.1	19.6	29.8	2.4	11.6	Pure sumac	Sumac.
158	Salvatore Terrasi, Palermo.	E. F. Mulholland Co., Boston.	do	Mar. 23, 1905	Ventilated, guaranteed pure.	7.53	9.13	2.17	54.8	50.2	4.6	17.5	32.7	1.6	7.3	do	Do.
177	Giovanni Terrasi, Palermo.	Gillespie Bros. & Co., New York.	New York	Apr. 7, 1905	Warranted pure, ventilated.	7.37	9.91	2.48	55.7	50.6	5.1	19.0	31.6	1.8	10.2	do	Do.
178	Unknown	A. C. Lawrence Leather Co., Boston.	Boston	Apr. 13, 1905	Guaranteed pure	7.10	8.67	1.50	57.4	53.2	4.2	20.1	33.1	1.6	7.3	do	Do.
179	P. Savona, Palermo.	A. Klipstein & Co., Boston.	do	do	do	7.50	8.19	1.40	49.7	46.2	3.5	18.6	27.6	3.7	11.5	Lentiscus abundant.	Lentiscus.
180	do	do	do	do	do	7.56	8.49	1.33	50.3	47.0	3.3	20.7	26.3	3.5	15.6	Some lentiscus	Do.
181	C. D'Amico & fille, Palermo.	G. W. Varney Co., Boston.	do	do	Warranted 100 per cent pure.	7.46	8.79	1.51									
182		Office of Botanical Investigations, U. S. Dept. Agr.	Washington, D. C.		Lentiscus	8.52	6.40	.42	40.7	37.8	2.9	24.0	13.8	5.8	15.0	Lentiscus only	Lentiscus.
183		do	do		do	6.47	5.98	.41	42.4	39.3	3.1	25.2	14.1	6.8	15.9	do	Do.
193	Paolo Graziano, Palermo.	D. A. Shaw & Co., New York.	New York	Mar. 6, 1905		6.99	9.69	2.28	46.7	41.8	4.9	18.4	23.4	4.4	13.5	Lentiscus abundant.	Do.

194	Unknown	H. M. Rau, New York.	do	Apr. 20, 1905	Warranted pure leaf.	6.60	10.10	2.28	51.7	48.4	3.3	20.2	28.2	2.8	12.1	Pure sumac	Sumac.
195	Unknown	do	do	Apr. 20, 1905	Pure leaf	6.77	7.20	.66	54.8	50.4	4.4	18.0	32.4	1.6	7.0	do	
196	do	do	do	do	Warranted pure	7.49	10.53	2.55	50.0	46.6	3.4	19.2	27.4	3.5	11.5	do	
197	Shumac Steam Mills, Termini.	B. Voigt, New York.	do	do	25 per cent lentiscus warranted.	7.46	8.74	1.89	49.7	46.0	3.7	19.0	27.0	3.0	9.7	Lentiscus abundant, some tamarix.	
198	C. Wederkind & Co., Palermo	Leber & Sons, New York.	do	Apr. 18, 1905	Pure	6.88	7.47	1.35	50.4	45.9	4.5	19.3	26.6			Lentiscus abundant.	
199	Unknown	do	do	do	20 per cent lentiscus, extra ventilated.	7.39	8.79	1.89	53.3	49.2	4.1	18.8	30.4			Sumac only	
200	do	O. S. Janney & Co., New York.	do	do	Warranted pure	7.48	7.94	1.94	48.6	43.2	5.4	19.0	24.2	4.5	12.1	Lentiscus abundant.	
201	Fratelli Savona, Palermo.	W. L. Montgomery & Co., Boston.	do	Mar. 6, 1905		9.17	9.96	2.44	49.0	44.9	4.1	18.9	26.0			Some lentiscus	
202	G. Dalia & Fi., Palermo.	do	do	do		7.24	8.63	1.24	54.3	50.0	4.3	19.1	30.9			Pure sumac	
218	Salvatore Terrasi, Palermo.	A. B. Clark Co., Boston.	Boston	May 2, 1905	Guaranteed pure	7.67	8.29	1.73	57.6	52.1	5.5	18.7	33.4	1.8	6.2	do	
312	Unknown	O. S. Janney & Co., New York.	New York	Apr. 29, 1905	Warranted pure	7.32	8.27	1.42	47.2	41.7	5.5	19.9	21.8	6.0	15.4	Much lentiscus, some tamarix.	
313	do	do	do	do	do	7.82	7.51	1.15	48.3	43.1	5.2	19.7	23.4	4.7	12.6	Lentiscus abundant.	
322	do								51.2	47.9	3.3	21.0	26.9	5.2	17.1		
323	do								49.3	45.8	3.5	19.1	26.7	4.4	13.8		
324	do	H. M. Rau, New York.	New York	May 31, 1905	Ventilated, pure	8.07	8.66	1.94	54.7	49.5	5.2	18.1	31.4	1.9	7.9	Pure sumac	
325	Fratelli Savona, Palermo.	W. L. Montgomery & Co., New York.	do		Warranted pure, extra ventilated.	8.00	10.01	3.05	49.2	45.0	4.2	17.9	27.1	3.8	12.1	Lentiscus abundant.	
326	C. Wederkind & Co., Palermo.	Leber & Son, New York.	do		Pure, extra ventilated.	8.09	8.39	1.70	55.0	50.6	4.4	20.1	30.5	3.3	10.6	Sumac only	
327	F. G. Pipitone, Palermo.	Pfister & Vogel Leather Works, New York.	do	May 31, 1905	Warranted extra ventilated.	8.00	8.77	2.07	46.1	41.7	4.4	18.4	23.3	5.7	17.3	Lentiscus abundant.	
328	Unknown	A. Klipstein & Co., New York.	do	do	Pure, ventilated	8.06	9.42	2.08	50.9	46.3	4.6	17.1	29.2	2.8	8.9	Sumac only	
329	do	do	do	do	Pure sumac	8.04	8.57	1.97	57.4	52.8	4.6	19.6	33.2	2.4	7.8	do	
330	P. Savona & Co., Palermo.	do	do	June 5, 1905	Guaranteed pure	7.96	8.16	1.92	48.3	44.2	4.1	17.9	26.3	3.5	9.9	Lentiscus abundant.	
331	Unknown	do	do		10 per cent lentiscus, ventilated.	7.93	9.61	2.08	53.9	49.2	4.7	19.5	29.7	3.1	9.8	Lentiscus abundant, possibly some tamarix.	
332	Mormino & Fi., Termini.	B. Voigt, New York.	do	May 31, 1905	25 per cent lentiscus, Bull brand.				49.0	45.7	3.3	18.8	26.9	4.4	11.0	Lentiscus abundant.	
334	Salvatore Terrasi, Palermo.	A. B. Clark Co., Boston.	Boston	May 15, 1905	Warranted pure, ventilated.	8.16	8.30	1.59	59.2	54.0	5.2	19.2	34.8	2.4	7.9	Sumac only	
335	M. Pojero, Palermo.	W. L. Montgomery & Co., Boston.	do	June 28, 1905	Guaranteed pure, warranted genuine.	8.26	8.29	1.27	56.8	51.4	5.4	20.2	31.2	2.5	9.4	do	
336	do	do	do	do	Guaranteed pure	7.78	8.26	.34	56.2	51.7	4.5	20.2	31.5	2.4	9.3	do	

TABLE II.—*Chemical and microscopical examination of Sicilian sumac sampled in 1905*—Continued.

Laboratory No.	Consignor.	Consignee.	Collection of samples.		Statement on bags as to purity.	Chemical examination (per cent).										Microscopical examination.	Presence of lenticscus as indicated by color after drying.
			Place.	Date.		Moisture.	Ash.	Sand.	Total extract.	Soluble extract.	Insoluble extract.	Non-tannins.	Available tannins.	Color in one-half per cent solution. Red.	Color in one-half per cent solution. Yellow.		
337	E. Bertini, Palermo.	Winslow Bros. & Smith Co., Boston.	Boston	June 28, 1905	Warranted 100 per cent pure, extra ventilated.	7.97	7.67	1.56	58.6	53.8	4.8	18.9	34.9	1.7	6.8	Sumac only	
338	P. Savona & Co., Palermo.	A. Klipstein & Co., Boston.	do	do	Guaranteed pure, extra ventilated.	8.12	8.09	1.34	57.9	51.2	6.7	19.7	31.5	2.8	10.0	Lentiscus, small amount.	
339	Unknown	O. S. Janney & Co., Boston.	do	June 2, 1905	Warranted pure, ventilated.	7.86	8.83	1.53	54.8	49.4	5.4	20.0	29.4	3.0	11.8	Possibly an excess of stems.	
340	E. & A. Graziano, Palermo.	do	do	May 12, 1905	do	7.40	8.62	1.56	53.4	49.2	4.2	20.0	29.2			Sumac only	
341	G. Dalia & Fi., Palermo.	W. L. Montgomery & Co., Boston.	do	June 2, 1905	Warranted pure	8.44	8.53	1.38	54.9	50.0	4.9	19.2	30.8	2.0	8.5	do	
342	S. Puglisi, Palermo	do	do	do	25 per cent lentiscus, ventilated.	7.69	8.91	1.62	49.4	44.8	4.6	17.9	26.9	3.5	11.0	Lentiscus abundant.	
343	G. B. Casiglia & Figlio, Palermo.	J. S. Bent, Boston.	do	May 15, 1905	Strong and pure, extra ventilated.	7.61	9.56	1.83	52.7	47.4	5.3	17.4	30.0	2.0	8.0	Sumac only	
344	E. Bertini, Palermo.	Winslow Bros. & Smith Co., Boston.	do	June 6, 1905	Warranted 100 per cent pure, extra ventilated.	8.14	7.87	1.70	57.4	52.9	4.5	18.4	34.5	3.5	10.0	do	
345	E. & A. Graziano, Palermo.	O. S. Janney & Co., Boston.	do	May 12, 1905	Warranted pure, ventilated.	7.38	7.41	1.34	50.9	45.6	5.3	20.0	25.6	2.2	7.1	Lentiscus abundant, possibly some tamarix.	
346	E. Bertini, Palermo.	O. L. Lawrence Leather Co., Boston.	do	June 6, 1905	Guaranteed pure, extra ventilated.	8.20	7.88	1.51	56.5	52.6	3.9	18.7	33.9	1.3	4.7	Sumac only	
347	do	do	do	May 12, 1905	do	7.90	7.48	1.11	57.2	52.7	4.5	18.1	34.6	2.8	7.5	do	
348	Fratelli Savona, Palermo.	W. L. Montgomery & Co., Boston.	do	do	Warranted pure, extra ventilated.	7.37	9.23	2.01	52.6	48.5	4.1	19.4	29.1	3.4	10.1	Lentiscus abundant.	
349	P. Savona, Palermo.	A. Klipstein & Co., Boston.	do	do	Guaranteed pure, extra ventilated.	7.48	8.26	1.41	49.2	45.5	3.7	19.1	26.4	3.7	11.1	do	
350	do	A. Klipstein & Co., New York.	New York	June 6, 1905	Guaranteed pure	8.06	8.08	1.40	48.3	45.1	3.2	18.7	26.4	3.5	11.1	do	
351	do	do	do	May 8, 1905	Guaranteed pure, extra ventilated.	7.92	7.99	1.33	49.2	45.6	3.6	19.9	25.7	4.5	11.5	Lentiscus very abundant.	

352	E. & A. Graziano, Palermo.	D. A. Shaw & Co., New York.	.....do.....	May 2,1905	Warranted pure..	7.95	7.14	1.32	45.5	41.0	4.5	20.7	20.3	8.7	17.1	.....do.....	.....
353	Salvatore Terrasi, Palermo.	O. J. Monisealy, New York.	.....do.....	June 30,1905	Guaranteed pure, ventilated.	8.05	8.42	1.34	54.1	50.8	3.3	18.2	32.6	1.8	7.0	Barely a trace of lentiscus.	.....
354	Unknown.....	O. S. Janney & Co., Philadelphia.	.....do.....	June 13,1905	.....do.....	8.08	9.40	2.42	48.9	45.6	3.3	18.0	27.6	3.2	12.8	Sumac only.....	Sumac.
355	Salvatore Terrasi, Palermo.	O. F. Maniscalco, New York.	.....do.....	June 23,1905	Guaranteed pure .	7.76	8.40	1.71	56.0	51.6	4.4	16.9	34.7	1.2	6.5	.....do.....	Do.
356	C. Wederkind & Co., Palermo.	Leber & Son, New York.	.....do.....	May 8,1905	Pure, extra ventilated.	7.70	9.00	2.42	51.9	48.4	3.5	17.4	31.0	2.4	7.3	.....do.....	Do.
357	Giovanni Terrasi, Palermo.....	F. R. Leonori & Co., New York.	.....do.....	July 6,1905	Warranted 100 per cent pure.	9.46	8.18	1.52	54.3	50.1	4.2	16.6	33.5	1.8	7.8	.....do.....	Do.
358	.....do.....	.....do.....	.....do.....	June 10,1905	.....do.....	7.58	7.58	1.33	55.7	51.3	4.4	17.1	34.2	1.8	7.6	.....do.....	Do.
363	.....	W. L. Montgomery & Co., New York.	.....do.....	July 15,1905	Guaranteed pure .	8.47	8.53	1.59	54.2	50.3	3.9	18.8	31.5	1.8	8.0	.....do.....	Do.
372	G. Dalia & Fi., Palermo.	.....do.....	.....do.....	June 2,1905	Warranted pure..	7.84	9.13	1.57	53.8	50.2	3.6	19.6	30.6	2.3	6.8	.....do.....	Do.
373	P. Savona & Co., Palermo.	A. Klipstein & Co., New York.	.....do.....	.....do.....	Guaranteed pure .	7.65	7.87	1.92	49.8	46.7	3.1	19.3	27.4	3.7	9.6	Lentiscus abundant.	Lentiscus.
374	Francisco Basso, Palermo.	Henry Glick, New York.	.....do.....	June 29,1905	.....do.....	7.65	9.23	1.83	51.6	48.5	3.1	19.0	29.5	2.6	8.2	Sumac only.....	Sumac.
375	Unknown.....	A. Klipstein & Co.	.....do.....	July 12,1905	25 per cent lentiscus, warranted pure sumac.	7.93	8.09	1.44	56.6	52.6	4.0	19.2	33.4	2.0	6.2	.....do.....	Do.
376	Fratelli Verga, Palermo.	Henry Glick, New York.	.....do.....	July 27,1905	Warranted pure..	7.84	9.02	1.25	54.6	50.9	3.7	19.9	31.0	1.8	6.4	.....do.....	Do.
377	.....do.....	.....do.....	.....do.....	.....do.....	.....do.....	7.78	9.00	1.41	55.0	50.9	4.1	20.1	30.8	1.8	7.4	.....do.....	Do.
378	Unknown.....	O. G. Monisealy, New York.	.....do.....	June 30,1905	25 per cent lentiscus.	7.60	8.22	1.69	51.4	48.0	3.4	18.3	29.7	3.4	9.9	Lentiscus abundant.	Lentiscus.
379	C. Wederkind & Co., Palermo.	Leber & Son, New York.	.....do.....	June 24,1905	Pure sumac.....	7.70	8.68	1.44	54.7	50.8	3.9	19.8	31.0	1.8	8.4	Sumac only.....	Sumac.
380	P. Savona & Co., Palermo.	A. Klipstein & Co., New York.	.....do.....	.....do.....	.....do.....	7.63	7.65	1.31	49.7	46.2	3.5	18.9	27.3	3.7	12.5	Lentiscus abundant.	Lentiscus.
381	Unknown.....	Knauth, Nichol & Kuhn, New York.	.....do.....	July 18,1905	Guaranteed pure .	7.72	8.90	1.59	56.6	51.2	5.4	19.4	31.8	2.3	8.4	Sumac only.....	Sumac.
392	E. Bertini, Palermo.	A. C. Lawrence Leather Co., Boston.	Boston.....	Aug. 3,1905	Guaranteed pure, extra ventilated.	8.04	8.52	1.44	50.9	47.6	3.3	16.5	31.1	....	....	.....do.....	Do.
393	.....do.....	.....do.....	.....do.....	July 31,1905	.....do.....	8.48	7.56	1.16	55.8	51.2	4.6	17.4	33.8	....	....	.....do.....	Do.
394	C. Wederkind & Co., Palermo.	Leber & Son, New York.	New York....	June 8,1905	Pure.....	7.77	9.04	1.60	53.1	48.2	4.9	18.3	29.9	....	....	.....do.....	Do.
395	.....do.....	.....do.....	.....do.....	May 11,1905	.....do.....	7.77	8.62	1.48	54.8	50.0	4.8	18.7	31.3	1.4	10.4	.....do.....	Do.
396	G. Sansone, Palermo	A. D. Shaw & Co., New York.	.....do.....	July 28,1905	Warranted pure, extra ventilated.	8.68	8.26	1.54	52.8	49.1	3.7	18.7	30.4	1.7	7.6	Lentiscus, small amount.	Lentiscus.
397	G. Dalia & Fi., Palermo.	W. L. Montgomery & Co., New York.	.....do.....	.....do.....	Warranted pure..	8.49	8.29	1.37	53.4	50.4	3.0	19.2	31.2	1.7	8.3	Sumac only.....	Sumac.
398	Unknown.....	O. S. Janney & Co., New York.	.....do.....	Apr. 24,1905	.....do.....	7.79	7.47	1.29	49.8	45.1	3.7	20.0	25.1	4.5	9.8	Lentiscus abundant.	Lentiscus.
399	Giovanni Terrasi, Palermo.	F. R. Leonori & Co., New York.	.....do.....	May 8,1905	100 per cent guaranteed pure, extra ventilated.	8.20	7.76	1.28	58.4	53.3	5.1	19.0	34.3	1.4	6.7	Sumac only.....	Sumac.

TABLE II.—*Chemical and microscopical examination of Sicilian sumac sampled in 1905*—Continued.

Laboratory No.	Consignor.	Consignee.	Collection of samples.		Statement on bags as to purity.	Chemical examination (per cent).										Microscopical examination.	Presence of lentiscus as indicated by color after drying.
			Place.	Date.		Moisture.	Ash.	Sand.	Total extract.	Soluble extract.	Insoluble extract.	Non-tannins.	Available tannins.	Color in one-half per cent solution. Red.	Color in one-half per cent solution. Yellow.		
400	P. Savona & Co., Palermo.	A. Klipstein & Co., New York.	New York	May —, 1905	Guaranteed pure	8.09	7.43	1.08	48.8	46.1	2.7	19.6	26.5	4.1	11.2	Lentiscus abundant.	Lentiscus.
401	Dott. F. Niceta, Palermo.	Zinssen & Co., Inc., Hastings-on-Hudson.	do	June 23, 1905	Pure leaf	7.95	7.93	.50	56.6	53.0	3.6	19.8	33.2	1.7	5.2	Sumac only	Sumac.
402	Unknown	H. M. Rau, New York.	do	June 29, 1905	Finest quality, ventilated.	7.62	8.43	1.05	55.4	51.3	4.1	19.1	32.2	1.5	7.2	do	Doubtful.
403	Mormino & Fi., Palermo.	B. Voigt, New York.	do	June 14, 1905	25 per cent lentiscus, ventilated, warranted.	7.77	10.95	3.05	47.3	44.4	2.9	19.4	25.0	4.8	14.2	Lentiscus abundant.	Lentiscus.
404	Giovanni Terrasi, Palermo.	F. R. Leonori & Co., New York.	do	July 29, 1905	100 per cent warranted, pure Sicily sumac.	8.03	8.58	1.30	55.2	51.4	3.8	18.8	32.6	1.5	8.0	Sumac only	Sumac.
407	Francisco Basso & Co., Palermo.	H. M. Rau, New York.	do	May 22, 1905	Guaranteed pure, extra ventilated.	7.15	7.46	.68	50.9	48.0	2.9	20.4	27.6	3.7	9.7	Some lentiscus	Lentiscus.
408	Unknown	do	do	July 27, 1905	Pure leaf, first quality.	7.40	7.22	.69	55.5	51.6	3.9	20.5	31.1	2.7	7.3	Sumac only	Do.
409	Dott. F. Niceta, Palermo.	Zinsser & Co., Inc., Hastings-on-Hudson.	do	May 31, 1905	Pure leaf	7.89	7.66	.60	57.2	53.9	3.3	19.6	34.3	1.8	5.2	do	Sumac.
410	do	do	do	June 10, 1905	do	8.18	7.85	.90	56.0	52.5	3.5	20.0	32.5	1.8	6.4	do	Do.
411	V. Vitrano, Palermo	H. M. Rau, New York.	Baltimore		Sicily leaf	7.82	6.40	.38	55.5	52.4	3.1	20.0	32.4	1.3	4.9	do	Do.
412	Dott. F. Niceta, Palermo.	Zinsser & Co., Inc., Hastings-on-Hudson.	New York	June 14, 1905	Pure leaf	7.54	7.62	.75	55.7	52.7	3.0	20.4	32.3	1.7	6.6	do	Do.
413	do	do	do	June 30, 1905	do	8.00	7.72	.34	55.7	51.8	3.9	18.6	33.2	1.5	4.8	do	Do.
414	Francisco Basso & Co., Palermo.	H. M. Rau, New York.	do	June 29, 1905	Guaranteed pure leaf, extra ventilated.	7.44	6.89	.63	51.7	48.5	3.2	19.7	28.8	3.3	9.3	Some lentiscus	Do.
415	Unknown	do	do	May 24, 1905	Warranted pure	7.21	8.66	1.75	53.2	49.7	3.5	20.1	29.6	2.7	8.8	Sumac only	Do.
416	P. Savona & Co., Palermo.	A. Klipstein & Co., New York.	do	June 6, 1905	Warranted pure leaf.	8.15	6.69	.56	54.5	50.4	4.1	19.2	31.2	1.7	5.5	Considerable stem tissue.	Do.

417	Unknown	H. M. Rau, New York.	do	May 31, 1905	Pure, first quality	7.73	7.44	1.06	55.2	51.9	3.3	20.1	31.8	1.7	5.2	do	Do.
432	R. Orto di Palermo, Palermo.	Bureau of Chemistry.		1905	*Coriaria myrtifolia.*	8.07	4.76	.26	45.9	41.7	4.2	22.6	19.1	14.5	28.7		
433	do	do		1905	*Tamarix africana.*	1056	10.59	1.19	43.5	39.7	4.8	23.8	15.9	31.6	39.6		

[a] Received from J. S. Young, Baltimore, Md.

SUMMARY AND AVERAGES.

Samples.	Moisture.	Ash.	Sand.	Total extract.	Soluble extract.	Insoluble extract.	Non-tannins.	Available tannins.	Color in one-half per cent solution.	
									Red.	Yellow.
All samples:										
Average	7.79	8.18	1.41	52.5	48.4	4.1	19.5	28.8	3.1	10.7
Maximum	9.46	10.95	3.05	59.2	55.4	6.7	22.7	35.1	11.2	27.8
Minimum	6.34	6.12	.28	45.5	41.8	2.6	17.1	19.6	.8	4.7
Pure sumac:										
Average								31.9	2.1	9.4
Maximum								35.1	3.5	12.8
Minimum								27.4	.8	4.7
Adulterated samples:										
Average								26.6	4.1	11.8
Maximum								33.3	11.2	27.8
Minimum								19.6	1.9	5.6

INVESTIGATION OF 1907.

During 1905 and 1906 there was so much agitation of the question of sumac adulteration in the leather trade journals, and buyers had to become so well informed on the question, that it was thought advisable again to collect and examine samples. This was done in the spring of 1907, exactly as before, the samples being secured from all incoming consignments for a time before they passed into the hands of the consignee. The results of the examination of these samples are given in Table III, page 22.

DISCUSSION OF ANALYTICAL DATA.

Seventy-five per cent of the 53 samples examined were pure sumac or contained but traces of other material such as may have been present accidentally. The pure samples contained from 25.6 to 35.7 per cent and averaged 30.6 per cent of tannin, or 1.3 per cent lower than the 1905 samples. Microscopical examination showed that 25 per cent of the samples examined were adulterated with lentiscus, while one sample was pure lentiscus and another was Turkish sumac. The adulterated samples contained from 22.4 to 30.4 per cent and averaged 26.3 per cent of tannin or 0.3 per cent lower than the 1905 samples. These facts indicate that while adulteration is not so generally practiced as in 1905, individual shipments are apparently adulterated to about the same extent.

The lowest tannin content of all the samples was 22.4 per cent, the highest 35.7 per cent, and the average 29.4 per cent, the latter figure being practically identical with the average tannin content of the 1905 samples. Color tests were made on but few extracts, which indicated a somewhat higher average color in the pure 1907 samples than in the pure 1905 samples. Only 3 of the 13 samples which were found to be adulterated were labeled to that effect. The other samples were either labeled pure sumac or marked so as to give the impression that they were pure Sicilian sumac.

These results indicate that from 1905 to 1907 there was a decrease of about 16 per cent in the importation of adulterated shipments of sumac, but that those shipments which were sophisticated had been adulterated with practically the same percentage of lentiscus as formerly. The practice of labeling adulterated shipments "pure sumac" or "warranted 100 per cent pure sumac" appears to be as general as formerly, so that it is still absolutely necessary for a buyer who would be sure that he is purchasing a pure, high-grade sumac to have it examined.

COMMENTS BY IMPORTERS.

A copy of each analysis was sent to the consignee in all cases, but in some instances they were returned marked "Not found" and these firms could not be located. In a few cases the consignees made some comments, the most important of which are quoted below:

Your laboratory No. 198 [a] represents an importation of sumac with 25 per cent lentiscus, especially so ordered and imported for a New York firm with their knowledge that it was so admixed and was known in the trade as No. 2 goods. Laboratory No. 156,[b] showing an abundance of lentiscus * * * [is] the same as lot No. 198 * * * [and] has been imported with the condition of second quality, i. e., to contain 25 per cent lentiscus.

LEBER & SON.

Leber & Son again stated on February 20, 1908, that the lot from which sample No. 1511[c] was taken was imported mixed with lentiscus on the order of the purchaser.

Analysis of Nos. 124 to 128 * * * agree very closely with our own determinations. * * *

J. S. YOUNG & CO., LTD.
By CHARLES R. DELANEY, *Chemist.*

[a] There were 280 bags in this invoice.
[b] There were 140 bags in this invoice.
[c] There were 70 bags in this invoice.

TABLE III.—*Chemical and microscopical examination of Sicilian sumac sampled in* 1907.

Laboratory No.	Consignor.	Consignee.	Collection of samples.		Statement on bags as to purity.	Chemical examination.							Microscopical examination.
			Place.	Date.		Total extract.	Soluble extract.	Insoluble extract.	Nontannins.	Available tannin.	Color in one-half per cent solution.		
											Red.	Yellow.	
						Per cent.	*Per cent.*	*Pr. ct.*	*Per cent.*	*Per cent.*			
1509	Unknown	Fuerst Bros. & Co., New York.	New York	Apr. 9, 1907	No statement	50.76	47.50	3.26	20.54	26.96			Sumac only.
1510	Unknown (Palermo)	Core & Herbert, New York	do	do	Warranted pure sumac.	58.08	54.50	3.58	19.29	35.21			Do.
1511	C. Wederkind & Co., Palermo	Leber & Son, New York	do	do	25 per cent lentiscus.	49.33	45.66	3.67	20.21	25.45			Abundance of lentiscus.
1512	Unknown	A. Klipstein & Co., Philadelphia.	do	do	100 per cent pure Sicily sumac.								Sumac only.
1513	C. Wederkind & Co., Palermo	Leber & Son, New York	do	do	Extra ventilated, non plus ultra.	49.90	46.77	3.13	20.58	26.19	3.0	11.0	Sumac with bare trace of lentiscus (accidental?).
1514	Mormino, Termini	H. M. Rau, New York	do	do	Extra pure	54.34	50.80	3.54	20.56	30.24	3.0	11.0	Sumac only.
1515	C. Wederkind & Co., Palermo.	Leber & Son, New York	do	do	Extra ventilated, steam ground.	51.94	48.80	3.14	20.90	27.90	2.6	10.4	Do.
1516	do	do	do	do	Extra ventilated, non plus ultra.	51.74	48.47	3.27	21.00	27.47	2.8	11.5	Do.
1517	do	do	do	do	Steam ground, non plus ultra.	49.51	46.13	3.38	20.53	25.60	2.7	10.0	Do.
1518	Unknown	do	do	do	Guaranteed pure	52.59	48.64	3.95	20.71	27.93	3.0	14.0	Do.
1519	C. W. Saurenbaus, Palermo	A. Klipstein & Co., Boston	Boston	do	100 per cent pure Sicily.	57.63	54.70	2.93	19.15	35.55	2.6	10.6	Do.
1520	Unknown	do	New York		Pure Sicily, 100 per cent.	47.91	46.02	1.89	19.51	26.51	4.8	28.0	Do.
1521	do	A. Klipstein & Co., New York	do	Apr. 9, 1907	Pure Sicily sumac, 25 per cent lentiscus.								Do.
1522	S. Falcone, Palermo	H. M. Rau, New York	do	do	Warranted 100 per cent pure.	55.47	51.96	3.51	20.17	31.79	2.0	9.8	Do.
1523	Unknown (Palermo)	O. S. Janney & Co., New York	do	Mar. 27, 1907	Warranted pure	49.65	45.36	4.29	19.77	25.59			Sumac with abundance of lentiscus.
1524	P. Mancuso, Palermo	J. B. Moors & Co., Boston	Boston	do	Warranted strictly pure.	58.42	54.51	3.91	19.97	34.54	2.3	12.0	Sumac only.
1525	do	W. L. Montgomery & Co., Boston.	do	do	Warranted pure sumac.	58.26	55.22	3.04	19.51	35.71	2.0	11.0	Do.

1526	Unknown	F. B. Caswell, New York	New York	do	No statement	54.79	49.94	4.85	22.75	27.19	2.3	13.0	Do.
1527	do	W. L. Montgomery & Co., Boston.	do	do	Guaranteed pure	57.75	54.16	3.59	20.31	33.85	1.9	9.2	Do.
1528	Mormino & Fi., Termini	H. M. Rau, New York	do	Apr. 9,1907	Ventilated, extra pure.	54.89	50.80	4.09	19.04	31.76			Sumac with trace of lentiscus.
1530	Unknown	F. R. Leonori & Co., New York.	do	do	Pure and prime 100 per cent.	46.92	43.98	2.94	21.52	22.36			Composed largely of lentiscus, doubtful if any sumac present.
1575	Mormino & Fi., Termini	H. M. Rau, New York	do	Apr. 18,1907	Steam ventilated, extra pure.	54.30	52.34	1.96	20.20	32.14			Sumac only.
1576	G. Dalia & Fi., Palermo	W. L. Montgomery & Co., Boston.	do	do	Guaranteed pure	52.50	49.44	3.06	19.32	30.12			Do.
1757	Unknown	O. S. Janney & Co., New York.	do	May 10,1907	First quality ground, warranted pure.	47.97	44.09	3.88	19.94	24.15			Abundance of lentiscus.
1758	do	do	do	do	Guaranteed pure sumac.	51.27	48.12	3.15	19.58	28.54			Sumac only.
1759	do	A. D. Hitch & Co., New York.	do	do	do	55.66	53.28	2.38	19.56	33.72			Do.
1760	C. Wederkind & Co., Palermo.	Leber & Son, New York	do	do	Extra ventilated, steam ground, non plus ultra.	50.82	46.88	3.94	19.32	27.56			Sumac with small amount of lentiscus.
1761	Unknown	Psaki Bros., New York	do	do		52.5	50.2	2.4	19.3	30.9			Turkish sumac.
1762	do	A. Klipstein & Co., New York.	do	do	Pure Sicily sumac, 100 per cent.	51.22	48.32	2.90	19.58	28.74			Sumac only.
1763	do	do	do	do	Lentiscus to 20 per cent.	52.32	49.14	3.18	18.76	30.38			Sumac and abundance of lentiscus.
1764	Salvatore Falcone, Palermo	Marden, Orth & Hastings, Boston.	Boston	do	Pure masculino leaf, warranted 100 per cent.	52.40	49.18	3.22	20.30	28.88			Do.
1765	do	Klipstein & Co., Boston	do	Apr. 29,1907	do								Sumac with considerable amount of lentiscus.
1766	Mormino & F., Palermo	H. M. Rau, Boston	do	Apr. 23,1907	Extra pure sumac								Sumac only.
1767	P. Mancuso, Palermo	W. L. Montgomery & Co., Boston.	do	do	Warranted pure sumac.								Do.
1768	Unknown	A. B. Hitch & Co., New York.	New York	Apr. 24,1907	Guaranteed pure sumac.								Do.
2033	G. Dalia & Fi., Palermo	W. L. Montgomery & Co., Boston.	Boston	May 22,1907	Guaranteed pure								Do.
2034	Salvatore Falcone, Palermo	Marden, Orth & Hastings, Boston.	do	May 14,1907	Warranted 100 per cent pure, best quality masculino.								Sumac with traces of lentiscus.
2035	Mormino & Fi., Termini	H. M. Rau, New York	New York	May 13,1907	Extra pure								Sumac only.
2036	S. Falcone, Palermo	W. L. Montgomery & Co., Boston.	Boston	June 17,1907	Warranted 100 per cent pure, best quality masculino.								Sumac and some lentiscus.
2037	C. Wederkind & Co., Palermo	Leber & Son, New York	New York	do	Extra ventilated, steam ground, non plus ultra.								Sumac.

TABLE III.—*Chemical and microscopical examination of Sicilian sumac sampled in* 1907—Continued.

Laboratory No.	Consignor.	Consignee.	Collection of samples.		Statement on bags as to purity.	Chemical examination.							Microscopical examination.
			Place.	Date.		Total extract.	Soluble extract.	Insoluble extract.	Nontannins.	Available tannin.	Color in one-half per cent solution.		
											Red.	Yellow.	
						Per cent.	*Per cent.*	*Pr. ct.*	*Per cent.*	*Per cent.*			
2038	Unknown	F. R. Leonori & Co., New York.	New York	June 17, 1907	100 per cent extra ventilated.								Lentiscus, no sumac found.
2039	G. Dalia & Fi., Palermo	W. L. Montgomery & Co., Boston.	Boston	do	Pure superior quality.								Sumac only.
2040	Unknown	A. Klipstein & Co., New York.	New York	do	100 per cent pure Sicily sumac.								Do.
2041	do	do	do	do	do								Do.
2042	do	do	do	do	Finest Sicily sumac, 20 per cent lentiscus.								Sumac and lentiscus.
2043	G. Dalia & Fi., Palermo	W. L. Montgomery & Co., Boston.	Boston	do	Warranted pure sumac.								Sumac only.
2044	S. Falcone, Palermo	A. Klipstein & Co., Boston	do	do	Warranted 100 per cent pure, best quality masculino.								Sumac with abundance of lentiscus.
2045	C. Wederkind & Co., Palermo	Leber & Co., New York	New York	do	Non plus ultra								Sumac only.
2046	S. Falcone, Palermo	H. M. Rau, New York	do	do	No. 1, 100 per cent pure masculino leaf.								Do.
2047	Unknown	Fuerst Bros., New York	do	do	Finest quality warranted extra.								Sumac with trace of lentiscus.
2048	S. Falcone, Palermo	A. Klipstein & Co., New York.	do	do	100 per cent pure masculino leaf.								Sumac with some lentiscus.
2049	Unknown	O. S. Janney & Co., New York	do	June 6, 1907	First quality, warranted pure.								Sumac with abundance of lentiscus.
2050	do	do	do	do	do								Do.

SUMMARY AND AVERAGES.

Samples.	Available tannin.	Samples.	Available tannin.	Samples.	Available tannin.
All samples:	*Per cent.*	Pure sumac:	*Per cent.*	Adulterated samples:	*Per cent.*
Average	29.4	Average	30.6	Average	26.3
Maximum	35.7	Maximum	35.7	Maximum	30.4
Minimum	22.4	Minimum	25.6	Minimum	22.4

DETECTION OF ADULTERATION.

NOTES ON THE MICROSCOPICAL EXAMINATION OF SICILIAN SUMAC AND ITS ADULTERANTS.

By B. J. Howard, *Chief, Microchemical Laboratory.*

The differentiation of pure and adulterated sumac by means of the microscope is not at all a new procedure, but it does not appear to be generally employed by the trade in this country. The work done in this laboratory indicates that this is a convenient and quick method of identifying certain of the common adulterants in Italian sumac leaves, and that in the detection of the most common adulterant, *Pistacia lentiscus*, no great experience is necessary to obtain reliable results. The examinations here reported include only commercial samples, most of which were in a powdered form, and hence no studies of sections were made. The investigations have been in progress since 1903. The paper by Priestman[a] will be found very useful to beginners along this line, but the technique of the method as there described seems to leave something to be desired in the way of simplification. As will be shown, the technique adopted in this laboratory is quite different, and, it is believed, has some advantages over Priestman's.

APPARATUS AND REAGENTS.

The most important apparatus required is a good compound microscope giving a range of magnification of from about 75 to 200 diameters. Magnifications of 90 and 180 were actually used in the work here reported, but if approximately these powers are used, giving good definition, no trouble should be experienced. The instrument should have fine and coarse adjustments and a substage condenser with iris diaphragm. A mechanical stage with wide range of movement (about 2.5 cm or more) will be found very convenient, though it is not really necessary.

Microscope slides 25 by 75 mm (1 by 3 inches) and cover-glasses, round or square, are required, round covers of 0.75 inch diameter and from 0.17 to 0.25 mm in thickness, listed by some dealers in microscopical apparatus as No 2, are preferred. Some device for producing a small flame, such as a micro-bunsen burner or small alcohol

[a] J. Soc. Chem. Ind., 1905, **24**: 231.

lamp, is required. In addition to the above, a pair of teasing-needles, a pair of small forceps, and a scalpel should be secured.

As a clearing agent a chloral hydrate solution made up as follows was almost exclusively used: Chloral hydrate, 150 grams; water, 100 cc.

Among other reagents of occasional value the following should be noted: Alcohol of two strengths, 70 per cent and 95 per cent; two grades of glycerin, 100 per cent and 50 per cent (glycerin and water 1:1 by volume), and glycerin jelly are needed if permanent specimens are to be made, and this will almost always be done by careful workers.

The glycerin jelly is made up as follows: Best gelatin, 1.5 parts; water, 3 parts, and glycerin, 4 parts. Some persons [a] prefer to use only 1 part of gelatin, since it gives a jelly more easily worked than the amount mentioned. Soak the gelatin in the water until it is soft, add the glycerin, and heat over a water bath, finally adding two or three drops of carbolic acid as a preservative.

TECHNIQUE.

The difficulty encountered on examining specimens mounted in water or glycerin direct is due to the fact that they are too opaque and contain considerable air. Some means of clearing the fragments are necessary. Priestman [b] treated the sample with nitric acid, which attacked the more delicate tissues of the leaf first, and if the action was stopped at the right time, the leaf epidermis could be mounted as nearly clean tissues. This method is laborious if a large number of samples is to be tested, and seems to require considerable judgment as to just the stage at which the action is to be stopped, and hence is not desirable unless one is very familiar with microscopical technique.

In this work the chloral hydrate solution before mentioned was used. A small amount of the specimen is placed upon a slide with two or three drops of the solution and gently heated to boiling over the micro-bunsen burner or alcohol flame and kept gently boiling for about one minute. If the chloral hydrate solution boils away before the heating is finished, a few drops more are added, for if the specimens become dry the object of the treatment is defeated. After the boiling is completed the specimen is allowed to cool down somewhat, a cover-glass is placed over it and the specimen is ready for examination. If too much of the original specimen has been used, the mass will be too dense to give satisfactory results. A few tests, however, will demonstrate to the worker the most satisfactory amount

[a] Clark's Practical Methods in Microscopy, 2d edition, 1896, p. 243.

[b] Loc. cit.

to use. It is well to make several slides from the specimen, so as to get a good idea of its character.

Another method of procedure which some may prefer, and which lends itself readily to the examination of finely powdered samples, is the following: Place in a test tube a portion of the sample equal in size to a hazelnut, add a few cubic centimeters of the chloral hydrate solution and boil slowly for two or three minutes, allow to stand until the larger pieces have settled to the bottom and then remove a part of them with a pipette and mount on a slide in the usual manner.

Such treatment is all that is necessary in the preparation of samples for immediate examination. It is often desirable, however, to prepare specimens for future reference. For this purpose the specimen is cleared with chloral hydrate as described, the excess liquid is removed by a piece of filter paper, and then mounted in glycerin or glycerin jelly. To mount in glycerin, add to the moist fragments a small drop of the 50 per cent glycerin and after covering seal with a good microscopical cement. In order to mount in glycerin jelly, the sample is cleared and the excess chloral hydrate solution removed as previously directed, a tiny drop of 50 per cent glycerin is mixed with the moist fragments, and then a small piece of glycerin jelly (about a quarter of the size of a pea) is placed on the slide. The whole is gently heated until the jelly melts, and the fragments are mixed with the jelly by means of a teasing-needle or scalpel, care being exercised not to make bubbles in the mass, as they are difficult to remove. Care should also be taken not to heat the glycerin jelly on the slide enough to produce bubbles.

Permanent samples can be made, after clearing in chloral hydrate, by dehydrating in alcohol, clearing in xylol, and mounting in xylol canada balsam. This method is not satisfactory, however, unless the sample is stained; and with many small fragments, as is usual in a powdered sumac, this step is somewhat difficult and tedious.

SOME HISTOLOGICAL FEATURES.

A short description of the most characteristic histological features of sumac and the most important of its adulterants may be of value. Although written descriptions and photographs aid greatly, in beginning such investigations the microscopist should, of course, first work on samples of known purity, then on known mixtures, and finally on mixtures of a content unknown to him but prepared from authentic samples.

SICILIAN SUMAC (*Rhus coriaria*).

The upper epidermis of *Rhus coriaria* (Pl. I, fig.1) is made up of cells about 35μ in diameter (varying from 20μ to 50μ). They appear in the surface view to be bounded by walls with fairly straight sides—

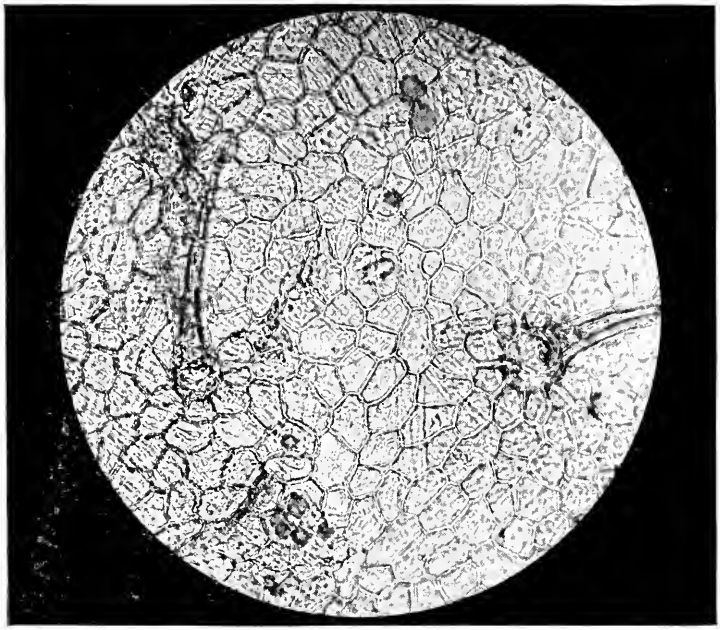

FIG. 1.—SICILIAN SUMAC (RHUS CORIARIA). UPPER SURFACE. ×150.

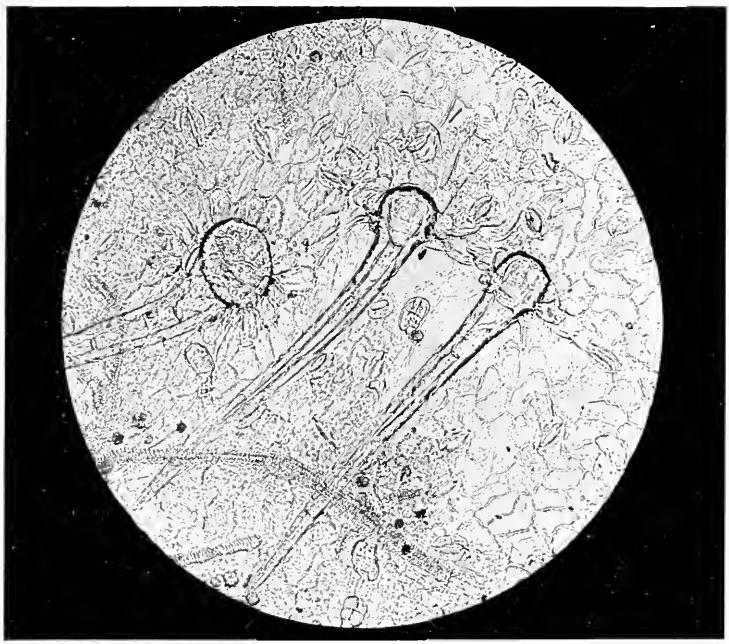

FIG. 2.—SICILIAN SUMAC (RHUS CORIARIA). LOWER SURFACE. ×150.

that is, the individual segments of the periphery are but little distorted or curved. The walls are thin and have a slight beading due to deep, broad, regular pits, while the corners come down to quite sharp definite angles. There are present an abundance of horn-shaped hairs (trichomes) from 50μ to 400μ long and from 35μ to 70μ diameter at the base. Although the cavity in some of the hairs, especially the smaller ones, is simple, in many of them it is divided by transverse septa into two or three chambers. The epidermal cells adjoining each trichome are commonly from 8 to 14 in number, though these limits are at times exceeded. They are much smaller in average size than those of the intra-trichome regions. The cells of the under epidermis (Pl. I, fig. 2) are somewhat smaller than those of the upper epidermis, and the walls are much more bent or curved, giving the cells very irregular outlines. The beading of the walls is of about the same prominence as in the upper surface. On the under surface are two kinds of trichomes: (1) horn-like forms similar to those on the upper surface but usually longer; (2) glandular forms of from 3 to 4 cells, raised on a single-celled stalk, the whole forming a club-shaped structure. The horn-like trichomes of both the upper and lower sides of a leaf have commonly a slightly warty surface. The lower epidermis is also furnished with many stomata or breathing pores, but there is no such regularity in the number and arrangement of the adjacent epidermal cells as in the case of the lentiscus. Rosette crystals of calcium oxalate are often visible in the leaf tissue when viewed from either side, though some leaves show but few or none. An excess of stems is detected by the presence of fibrous tissue in greater amount than in good normal samples. Many fragments of the powdered sumac leaf will show only the trichome scars, since in grinding they are frequently broken off.

LENTISCUS (*Pistacia lentiscus*).

The method of clearing by chloral hydrate has a tendency to produce clearer tissue in *P. lentiscus* than with *R. coriaria*. Both surfaces of *P. lentiscus* are free from trichomes. The upper epidermis (Pl. II, fig. 1) is made up of cells having very conspicuous walls. The outlines of the walls are straight and at the angles, instead of coming down to sharp points, are slightly rounded, giving to them a very distinctive appearance and one not to be confused with the surface appearance of *R. coriaria* or any of its other common adulterants. This point is not so clearly shown in the photomicrograph as in the specimens themselves since this feature was subordinated to producing the best general effect, the latter being much more important in its identification. The cells vary in width from 17μ to 30μ.

The under epidermis cells (Pl. II, fig. 2) have not quite so prominent walls as those of the upper layer and the outline is more inclined to be wavy. The limits of variation in diameter also exceed those of the upper surface. From six to ten cells are radially grouped around each stoma. In the ordinary clearing process these cells, together with the stomata, commonly clear up more perfectly than the rest of the epidermal cells, thus giving to the specimen when viewed under the microscope with the objective slightly out of perfect focus a mottled appearance which is very characteristic.

TAMARISK (*Tamarix africana*).

This material cleared in chloral hydrate is more brownish in color than the species previously mentioned. The most characteristic feature observed is a papillæ-like appearance on the surface of the leaves distinguishing it from the other plants studied. This is best observed on fragments which lie partially on edge, in which position the little protuberances are readily seen. (Pl. III, fig. 1.)

SMOOTH SUMAC (*Rhus glabra*).

Though this species is not very commonly found if at all in *Rhus coriaria* as imported into this country, it is one of the possible adulterants that should be kept in mind. On neither surface of the leaf are the horn-like trichomes present. The cells on the upper epidermis resemble those on the upper epidermis of the *R. coriaria*, being ordinarily from 25μ to 52μ across. The beaded cell walls noted in the case of the *R. coriaria* are very pronounced in the *R. glabra* (Pl. III, fig. 2), and, together with the absence of trichomes, have been used as the basis of its identification.

The under surface of the leaf has epidermal cells and stomata and glandular hairs very much like the *R. coriaria*, but the cell walls do not generally show quite so much undulation. The fact that the horn-like trichomes are absent from both sides of the leaf is of additional service in the identification of whole or rather coarsely ground material, but in very finely ground samples can not be relied upon with certainty.

CHEMICAL DETERMINATION OF ADULTERANTS.

In the detection of adulterants it is customary to place dependence only on the microscopical examination of the sample, no chemical tests being regarded as of practical value for this purpose, although Proctor[a] states that any sumac infusion rendered turbid by bromin water is open to grave suspicions. Work in this laboratory has shown that while pure sumacs are not as easily precipitated, requiring more bromin water than lentiscus extracts do, both the sumac

[a] Principles of Leather Manufacture, 1903, p. 272.

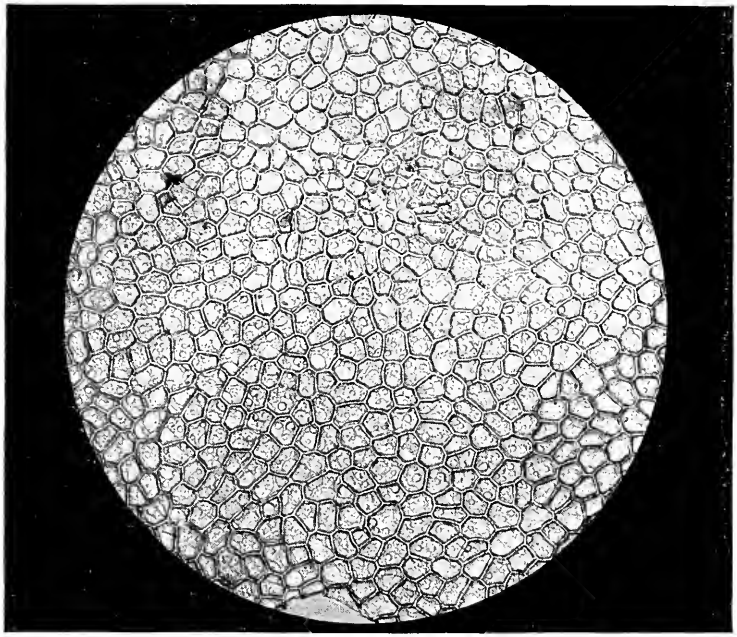

FIG. 1.—LENTISCUS (PISTACIA LENTISCUS). UPPER SURFACE. ×150.

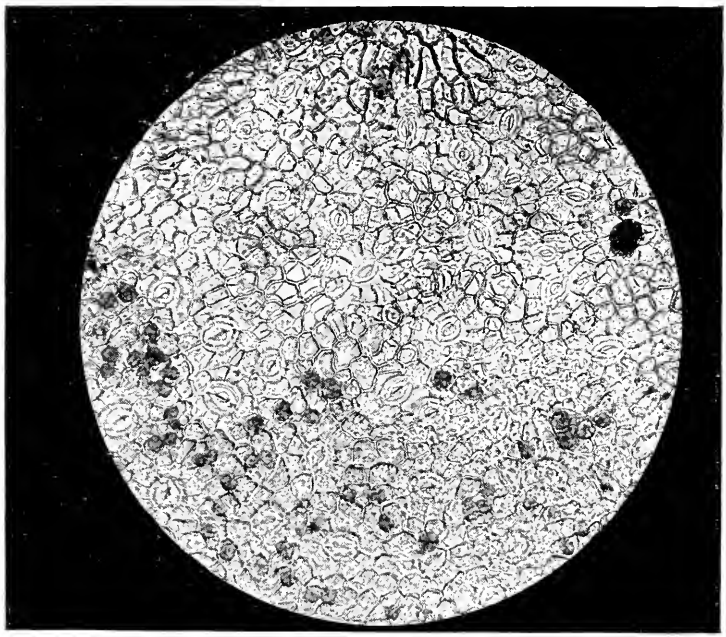

FIG. 2.—LENTISCUS (PISTACIA LENTISCUS). LOWER SURFACE. ×150.

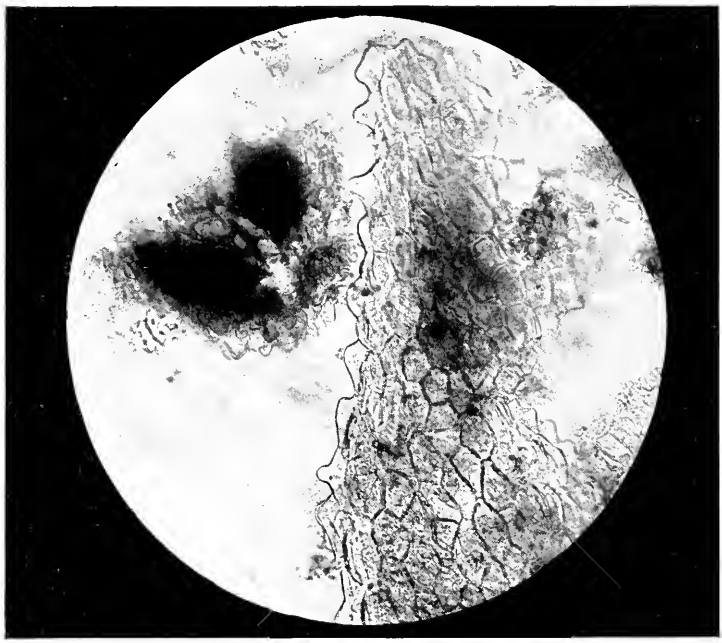

FIG. 1.—TAMARISK (TAMARIX AFRICANA), SHOWING PAPILLÆ OF EPIDERMIS. ×150.

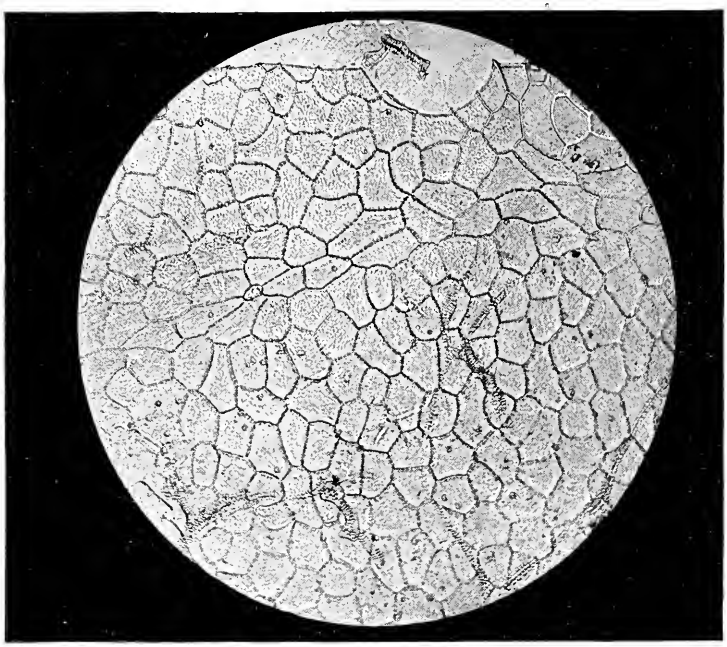

FIG. 2.—SMOOTH SUMAC (RHUS GLABRA). UPPER SURFACE. ×150.

and its adulterants give a precipitate on treating with a quantity of saturated bromin water, and, as a consequence, but little reliance can be placed on this test. One of the most reliable indications of adulteration is the color of the dried sample. If lentiscus is present it will darken greatly on heating, becoming a dirty light brown with a tinge of red, while pure sumac only turns a slightly darker yellow. The experienced analyst, having a pure sumac for comparison, can pick out in nearly all cases samples adulterated with lentiscus. That this test agrees well with the microscopical examination is shown by the last column of Table II, where the purity of the samples as indicated by the color after drying is given. Of a total of 91 samples examined, 82 agreed with the microscopical test, 3 were doubtful, and 5 were erroneous. Moreover the color of the extract has been found a valuable indication, samples adulterated with lentiscus giving a dark reddish extract, easily distinguished from pure sumac. As a rule, therefore, the experienced analyst can distinguish by means of the color of the extract and the dried material those samples which are adulterated with lentiscus, but if there is any uncertainty a microscopical examination must be made.

Neither the percentage of ash nor of sand is an indication of adulteration with lentiscus, as this leaf does not differ materially from sumac in these particulars. The samples of leaf and ground sumac contained on an average 1.41 per cent of sand, the highest amount found being 3.05 per cent. Assuming that there was no sifting out of sand in transit, there was no evidence of willful addition of sand to these samples, although several indicated that they were but imperfectly winnowed or ventilated. There was less than 1 per cent of sand in the unground leaf, while 106 samples of ground leaf averaged 1.62 per cent and 15 contained more than 2 per cent. Therefore 2 per cent of sand may very properly be considered the maximum sand content of a well-ventilated ground sumac. A larger content of sand indicates that the samples have been carelessly prepared.

EXTENT OF ADULTERATION.

From 25 to 41 per cent of the invoices of Sicilian sumac imported into the country are adulterated, and this adulteration is effected almost exclusively with lentiscus. These adulterated shipments are, as a rule, so labeled as to convey the impression that they are pure Sicilian sumac. It is sometimes claimed that shipments of sumac are mixed with lentiscus in accordance with the order of the importer. In such cases the consignment should be properly labeled indicating the amount of lentiscus used. The tannin content is from 2 to 7 per cent lower in the adulterated samples than in the pure sumacs, averaging about 4.5 per cent lower, and the color of the extract prepared from them is much darker than that of pure sumac extracts. While to the experienced analyst the color of the extract or of the dried material is generally indicative of the purity of the sample, only microscopical examination can definitely determine this question.

The adulteration of Sicilian sumac is of more importance than is indicated merely by a lower tannin content, otherwise American sumac could be used at a much smaller cost. When high-grade, light-colored leathers or durable sumac-tanned leathers are required, as for instance in bookbinding, adulteration results in discoloration and destruction of the leather in a much shorter time than when pure sumac is employed in tanning, and the money loss thus occasioned is many times the difference in cost between a pure and an adulterated sumac.

Aside from any ethical consideration, there is absolutely no advantage to the tanner in the purchase of adulterated sumac because, as a matter of fact, the tannin in such sumac costs more for a given amount than when bought in pure sumac. Thus taking the current quotations of from $71 to $72 per ton for sumac containing 29 per cent of tannin, $70 to $71 for 28 per cent, and $69 to $70 for 27 per cent, the tannin costs from 12.2 to 12.4 cents, from 12.5 to 12.7 cents, and from 12.7 to 13 cents per pound, respectively. That is, the tanner is making a lower grade leather at a greater cost when using adulterated sumac. Finally, as there may be a variation of as much as 10 per cent in the tannin content of pure sumac, it should always be bought on the basis of its tannin content, and if adulterated should be so labeled.

O